USAFA Discovery

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A New Path to the Moon

Cadets involved in research at the United States Air Force Academy's Department of Astronautics have helped uncover the properties of a newly discovered path to the Moon that is more efficient than previously discovered methods.

Trajectories taken by spacecraft on their way to the Moon have typically taken one of the most efficient paths known. This trajectory is named after Walter Hohmann who developed the mathematics behind the trajectory in 1925. As space travel became a reality, this trajectory, or close approximations, has been used extensively to transfer spacecraft from one orbit to another. When lunar missions were designed, the Hohmann transfer method was also applied in order to get to the Moon using the smallest rockets possible (Figure 1).

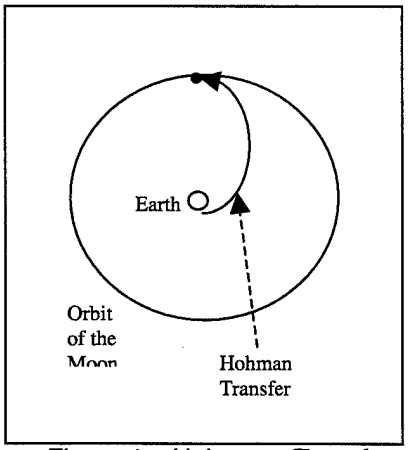

Figure 1 – Hohmann Transfer

In the 1960's, methods were developed that allowed even more efficiency to be gained over the Hohmann transfer scenario by using gravity assists (or swing-bys). These gravity assists are accomplished by flying past a planet or asteroid on the way to the spacecraft's destination. The gravity assists allow the spacecraft to take some of the energy from the body that it passes in order to increase its own velocity.

However, when traveling from the Earth to the Moon there are no large bodies to swing by. So the traditional Hohmann transfers to the Moon continue to be used in most cases.

Recently, though, a few different efficiency improving methods have been pieced together to form what is called a Ballistic Capture Transfer (BCT). A BCT trajectory uses less fuel than the Hohmann transfer for lunar missions and is shown in Figure 2.

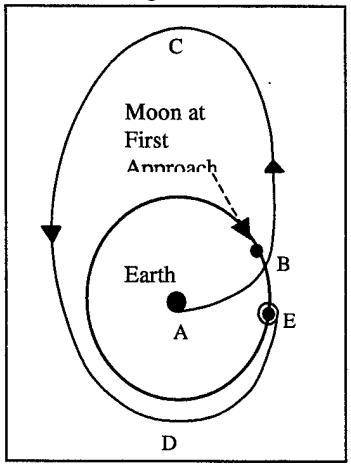

Figure 2 – Ballistic Capture Transfer

In this scenario, a spacecraft fires its engine from a near Earth parking orbit (A) to send it toward the Moon. When it reaches the Moon it uses a gravity assist to propel itself even further away from the Earth (B). As the spacecraft gets further from the Earth the gravitational pull of the Earth slows it down and causes it to return. However, near its furthest point (C) the Sun's gravitational pull causes the orbit to change shape so that as the spacecraft comes back it follows a path that closely parallels the Moon's orbit for several days (D).

While the spacecraft is traveling near the Moon at roughly the same velocity, the Moon captures the spacecraft in it's gravitational pull (E). The spacecraft is then in orbit around the Moon.

This new method is more complex than the Hohmann transfer, but from a fuel perspective it is more efficient. The Hohmann transfer requires the spacecraft engine to fire once at Earth to start its journey, and another engine firing to slow the spacecraft down and enter an orbit around the Moon. This new BCT trajectory still requires the engine to fire at the Earth to begin the transfer, but it approaches the Moon in such a way that the second engine firing is not necessary.

The longer travel time, larger distances from Earth and the added complexities are the trade-off for the improved fuel performance of the BCT. Since this new type of orbit has only been known about since the early 1990's, not much investigation has gone into it to help understand the various properties of this orbit.

In order to help reduce the complexity problem, over the past few years the Department of Astronautics has been studying this trajectory to help determine its viability as a standard transfer.

Some of the work done to date includes:

1) an investigation into the feasibility of using the BCT for small satellite missions to the Moon, Cadet 1st Class (C1C) Johnston A. Coil

2) an analysis of the effects of engine burn errors for BCT's, C1C Stephen J. Pinchak

3) an investigation of lunar capture conditions, Earth departure parameters and several other aspects of BCT trajectories, Dr. Scott Dahlke

Much of this work has been done in an effort to evaluate this trajectory as an option for use on a future USAF Academy small satellite mission. The Department of Astronautics is looking

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into a lunar mission to follow its current Earth orbiting satellite project.

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Department Research News

Department of Behavioral Sciences

During the first half of this year, Aptima, Inc. (Woburn MA), collaborated with faculty and students at USAFA to complete the first in what we hope will be a long series of studies to investigate fundamental human-performance issues in Command and Control (C2) decision making. Our collaboration brings together Aptima researchers, engineers and technologies, with expert faculty and high-quality students from the Behavioral Science and Leadership (DFBL) and Management (DFM) departments at the Academy. Our initial efforts centered on team-performance research using Aptima's DDD team-in-the-loop simulation as an experimental platform, high quality USAFA cadet participants, and innovations in performance assessment in simulation-based experimentation. Our collaborative work has thus far been supported through Aptima's Phase II SBIR, *A System to Enhance Team Decision Making Performance* (contract F41624-98-C-6010) and related funding, but has generated AFOSR interest outside the scope of that contract. Over the coming months, Aptima and USAFA will continue to work together under Aptima's Phase II contract, and hope to acquire additional support to broaden our research scope. This fall, we will also integrate follow-on studies and related research more closely with the curricular goals of select courses. We have already begun to integrate our AWACS team-organization studies into the curriculum of a Fall '99 Leadership course. This integration will provide research and educational benefits by providing broader access to quality teams of cadets, and exposing those cadets to the inner workings of behavioral research through participation as subjects, data analysis, and application of results.

One of the goals of training at USAFA, in general, and the Leadership Reaction Course (LRC), in particular, is having cadets learn how to solve problems effectively as a team. One relatively new idea in the realm of social psychology is that of "teamthink," in which members of a team focus on the individual &/or strengths of each team member and uses the diversity of the group to help solve problems. In a research project being conducted by members of the Department of Leadership and Behavioral Sciences, the effects of a brief intervention meant to train basic cadets in a teamthink approach to solving problems as presented by the LRC are being examined . The subjects will be approximately 1000 basic cadets participating in Basic Cadet Training. There are three conditions - the experimental condition in which a 5-minute training session on teamthink is presented, a control condition in which a 5-minute training session on core values is presented, and a no-treatment control condition in which there is no intervention whatsoever. The main dependent variable is level of success on a difficult group problem solving task that is part of the LRC and that has only an approximately 50% successful completion rate. The hypothesis is that the teams that receive the teamthink training will successfully complete more components of the solution to a group problem-solving task than groups that receive a similar intervention focusing on core values or no intervention at all. If a brief intervention in team-think is effective in enhancing problem-solving at the LRC, this may have implications for additions to our curriculum in leadership, management, and other courses that require cadets to solve problems in groups.

LCDR Russell Shilling was appointed to the Steering Committee for the Crew System Ergonomics Information Analysis Center (CSERIAC). CSERIAC provides a variety of products and services to government, industry, and academia to promote the use of ergonomics in the design of human-operated equipment. CSERIAC is one of more than 20 Information Analysis Centers that provide technical information services in a variety of subject areas.

Department of Engineering Mechanics

Bonded Repair to Stiffened Panels

The focus of this research is how to repair damaged aircraft structure with composite patches. Today, cracks in USAF aircraft are routinely repaired with riveted doublers or, in cases where such a repair is not practical, the damaged part is often replaced (sometimes at great expense). An alternative method of repair, whose use is becoming more widespread in recent years, is to bond a composite patch over the damage site. This technique is often referred to as "crack patching." Some of the advantages of crack patching over riveted repairs are lighter weight, no drilling new holes for rivets (more damage!), and a lower repair profile.

When the Air Force discovered that many of its C-141B Starlifters had wing cracks just after DESERT STORM, 45 of the aircraft were grounded, and the remaining 198 were put on severe flight restrictions (see http://www.af.mil/news/Jan1995/N19950130_070.html). These wing cracks had to be repaired or the affected wing panels replaced. Riveted repairs were not an option due to the complex structural geometry in the vicinity of the cracks and the high loads on the wing panels, so bonded repairs were used. Though some badly damaged wing planks were replaced, the majority of the repairs were bonded composite patches that were applied both inside the wings and outside. Warner-Robins Air Logistic Center (GA) performed the majority of the repair work. (WR-ALC has a mobile repair capability that travels the world making advanced bonded repairs to USAF aircraft. In addition to the C-141B, bonded repairs have been performed on C-130, B-1B, and F-16 aircraft.)

Follow-on research to this repair effort is ongoing at the USAFA Center for Aircraft Structural Life Extension (CAStLE). This research, headed up by Mr. Cornelis Guijt and Mr. Stephan Verhoeven, has afforded cadets a chance to get involved in Air Force research of the highest relevance. Cadets have been involved in measuring the strains in stiffened panels that simulate the C-141B wing skin. Their strain surveys have led to a more accurate assessment of the fidelity of these specimens. Other ongoing work at the CAStLE includes studying the growth of cracks in the panels when subjected to fatigue loading. Both patched and un-patched panels are included in these studies.

Department of English

Major Thomas W. Krise, Associate Professor and Executive Officer of the Air Force Humanities Institute, has assembled, edited, and written an introduction to an anthology of Caribbean literature, forthcoming shortly from the University of Chicago Press.

Although the colonies in the West Indies were as important to the expanding British empire as those in North America, writings from the British West Indies have been conspicuously absent from anthologies of seventeenth- and eighteenth-century British literature. In this first literary anthology dedicated to the region,

Major Krise gathers important but little-known descriptions, poems, narratives, satires, and essays written in and about this culturally rich and politically tempestuous region.

Highlights of Major Krise's volume include several of the earliest protests against slavery; a superb ode by the Cambridge-educated Afro-Jamaican poet Francis Williams; James Grainger's extended georgic poem, *The Sugar Cane*; Frances Seymour's poignant tale of the Englishman Inkle who sells his Indian savior-lover Yarico into slavery; and several descriptions of the West Indies during the early years of settlement.

Department of Foreign Languages

Air Force Language Link: On-Line Russian Language Maintenance and Development establishes a prototype for Air Force Language Link (AFLL), an online Web archive to provide Air Force personnel worldwide with information and authentic materials for maintaining and improving foreign language skills. The technologies employed should apply to other disciplines to foster lifelong learning in virtually all subject matter areas.

Major Stanley Supinski is conducting research on the use of three common educational and communication technologies -- the Internet, compact disk, and email --to study the feasibility of delivering Russian Language maintenance and development in a distance learning mode. Thirty subjects across the Air Force (From Misawa AB, Japan to Langley AFB, Virginia), and several who are deployed or TDY (Bosnia, Vicenza, and others), are participating in the 24-week course. The students will work in cooperative teams of five, using interactive courseware obtained primarily from a CD. They will also interact with each other and a native-Russian course moderator located in Colorado Springs, as well as receive additional, dynamic lessons from a course bulletin board. This truly virtual classroom and course should make optimal use of these technologies while reducing the need to send personnel for expensive in-residence courses. The course should also support the Air Force strategy of "Global Engagement" by increasing Foreign Area Officer and other linguists' Defense Language Proficiency Test scores. The study and course will be completed in July.

Human-Environmental Research Center (HERC)

During the past year, the HERC:

- Established the AFRL Operating Location in Biology when Dr. Ann Cox arrived in March. We also undertook the hiring of a contract research assistant. Mike Kirk joined us in June.
- Met with scientists at the Soldier Service Center (SSC) and at the Army Research Institute of Environmental Medicine (USARIEM) at Natick MA to coordinate joint research efforts. We drafted an MOA for USAFA-USARIEM research collaboration and initiated in July the first USARIEM collaborative research protocol, involving the USARIEM lab on Pike's Peak in a study of the effects of acclimatization to moderate altitude on performance at high altitude.
- Co-sponsored with IITA and DFE the in-house Pikes Peak Educational Innovations and Research Symposium (PPEIRS) in January. Edited and published the *Proceedings* as a USAFA technical report.
- Hosted visits and presentations by Dr. John Stern, Washington University, St Louis; Prof. Wolf Boucsein, U. Wuppertal, Germany; Dr. Alan Gevins, EEG Systems Lab, San Francisco; Maj Neal Baumgartner, Human Performance, Force Enhancement and Fitness Division, Department of Aerospace Physiology and Human Performance, USAF School of Aerospace Medicine; Dr. Stan Barnett, CSIRO, New South Wales, Australia; Dr. Jefferson Koonce, Center for Applied Human Factors in Aviation, University of Central Florida; and Dr. Bjorn Cedervall, Karolinska Institute, Stockholm.
- Supported faculty TDYs to the DOD Human Factors Engineering Technical Advisory Group (HFE TAG) meetings, the Aerospace Medical Association meeting, the Computer-Human Interaction meeting, the Rocky Mountain Bioengineering Symposium, and the Aviation Psychology meeting.
- Reviewed a draft of the AF Inspection Agency's Eagle Look report on Human Systems Integration in Air Force acquisition.
- Acquired at no cost the Navy's Automated Portable Test System (APTS) for computerized cognitive testing, and the Basic Flight Instruction Tutoring System (BFITS). Both programs are in use in fledgling research efforts.
- Drafted and revised the questionnaire for the IITA faculty notebook computer study. Analyzed and reported the demographic data. Completed 20 workstation ergonomics consults for notebook and desktop computer users.
- Created and hosted Airmanship Research Seminars for USAFA faculty and staff.

Dr. Cox conducted a successful pilot study with an international team at Colorado State University. Cell synchronies (by centrifugal elutriation) and comet assays were performed in the laboratories of Drs. John T. Lett and Susan M. LaRue at Colorado State University. Dr. Stanley B. Barnett (Commonwealth Scientific and Industrial Organisation, Australia) was supported in this endeavor by the Asian Office of Aerospace Research and Development or AOARD (AFOSR) in Tokyo, and Dr Cox was supported by AFRL/HEDB. Besides further characterizing the very sensitive L5178Y S/S cell line's (and its transfected offspring's) responses to toxic agents, it is hoped that we will be able to measure DNA damage and repair in neural cells using the comet assay.

34th Education Group

C1C Jeffrey J. Schrum presented his paper, "The German Speaking New Right: Culture Clashes in a European Context," at the European Community Studies Association (ECSA) Conference from 2-5 June 1999, held in Pittsburgh, PA. ECSA is one of the foremost scholarly organizations in the United States that follows European issues. Cadet Schrum was chosen to attend the conference as a result of a contest sponsored by the Western European Study Group of the Academy (WEASG) and organized by Lt Col Peter J. Heinz (DFF), President of the WEASG, and Dr. Charles Krupnick of the 34th Education Group. The trip was funded by a grant from the McDermott Foundation.

Lt Col Clayton K. S. Chun of the 34th Education Squadron was awarded the 1999 US Army Historical Foundation Award for his article "Winged Interceptor: Politics and Strategy in the Development of the Bomarc Missile," published in *Air Power History*, Winter 1998.

Publications and Presentations

34th Education Group

Publications:

CHUN, C. K. S. "Spending Your Nickel: How the Federal Government Evaluates Major Investments and Programs." *Journal of Applied Management and Entrepreneurship*, Jan 99.

DROHAN, T. A. US-Japan Security Relations: Toward an Equivalent Partnership. International Institute of Policy Studies Monograph, Summer 1999.

Presentations:

DROHAN, T. A. "The US-Japan Defense Guidelines: Adjusting the Alliance for the Twenty-First Century." National Institute of Defense Studies of Japan, Tokyo, Japan, 21 May 1999.

KRUPNICK, C. A. "Nuclear Notions in Europe: Prospects for Development of a European Nuclear Common Foreign and Security Policy." European Community Studies Association Bi-ennial Conference, Pittsburgh, PA, 2-5 Jun 99.

SCHRUM, J. J. "The German Speaking New Right: Culture Clashes in a European Context." European Community Studies Association Bi-ennial Conference, Pittsburgh, PA, 2-5 Jun 99.

Department of Aeronautics

Publications:

BRANDT, S. and W. Crisler. "Teaching the Nine Technologies of Conceptual Aircraft De-sign." Service Academies Conference, Apr 99.

MORTON, S. and P. Beran. "Hopf-Bifurcation Analysis of Airfoil Flutter at Transonic Speeds." *Journal of Aircraft*, Vol. 36, No. 2, Mar 99.

WOLF, J., J. Baughn, M. Anderson, and J. Mayhew. "Hysteresis and Uncertainty of Thermochromic Liquid Crystal Temperature Measurement Based on Hue." Proc 5th ASME/JSME Joint Thermal Eng Conf, Mar 99.

Presentations:

CRISLER, W. "X-38 Stability Derivative Experimental Results." NASA X-38 Aerodynamics Group Meeting, Houston, TX, May 1999.

MORROW, J., C. Cain, and D. Kaercher. "Active Control of a Delta Wing." 1999 AIAA Region V Student Conference, Minneapolis MN US, April 1999.

TUITE, J. "Mathematically Efficient Solution Techniques for Optimizing a System of Non-linear Equations Representing the Performance and Cost of a Non-ideal Gas Turbine Engine." Department of Aeronautics Brownbag Series, USAFA, CO, May 1999.

Department of Biology

Publications:

DEFUSCO, R. and C. Burney. "BAM (Bird Avoidance Model) 101." *Flying Safety*, 55(4):12-15 Apr 99.

OBRINGER, J., Stephen Phipps, and Martin Johnson. "Genetic Induction of Cultured Human Cells by High Energy Ultrashort Pulse Laser-Light." *AAAS SWARM Proceedings* Apr 99.

ROSS, M. "The treatment of low back pain in a middle-aged recreational athlete". *Athletic Therapy Today*, (4) 2: 22:1999

ROSS, M. "Effect of lower extremity position and stretching on hamstring muscle flexibility". *Journal of Strength and Conditioning Research*, 13 (2):124:1999.

Presentations:

DEFUSCO, R. "Birds and Flight Safety in the Middle East." Proceedings of International Meeting, Tel Aviv, Israel, Apr 99.

MCDONOUGH, P. and C. Powel. "Effectiveness of Bioresorbable and Non-bioresorbable Barrier Membranes in Guided Tissue Regeneration." Tri-Beta Biological Society, Grand Junction, CO, Apr 99.

NOYD, R. "Mycorrhizal Fungi: Its how they're all connected." Pikes Peak Mycological Society, Colorado Springs, CO, May 17, 99.

OBRINGER, J., Stephen Phipps, and Martin Johnson. "Genetic Induction of Cultured Human Cells by High Energy Pulsed Laser-Light Exposure." AAAS SWARM Meeting, Santa Fe, NM, April 1999.

OBRINGER, J. "The Human Genome Project." AAAS SWARM Meeting, Santa Fe, NM, Apr99.
ROSS, J. and S. Wartner. "Tracking *Dendroctonus ponderosae* Through Dying Forests: A Statistical Survey." Tri-Beta Biological Meeting, Grand Junction, CO, Apr 99.

SULLIVAN, R. "Instrumant Panel Scanning Analysis in the F-117A Stealth." Tri-Beta Biological Meeting, Grand Junction, CO, April 1999. (Cadet)

WESTMORELAND, D. & A. Moseley. The Cost of Bright Egg Coloration in American Robin Nests, 1999 Wilson Ornithological Meetings. Watertown, ME. May 99.

Department of Computer Science

Publications:

CHAMILLARD, A. T. and D. Karolick. "Using Learning Style Data in an Introductory Computer Science Course." *Proceedings of the Thirtieth SIGCSE Technical Symposium on Computer Science Education (SIGCSE '99)*, Mar 99.

CARLISLE, M. C. "Graphics for Free." *SIGCSE Bulletin*, June 99.

WHITE, G. B. and R. E. Sward. "Developing an Undergraduate Lab for Information Warfare and Computer Security." *Proceedings of the 1st World Conference on Information Security Education*, June 1999.

Presentations:

CHAMILLARD, A. T. and D. Karolick. "Using Learning Style Data in an Introductory Computer Science Course." Thirtieth SIGCSE Technical Symposium on Computer Science Education (SIGCSE '99), March 1999.

MOORE, J. A. and G. B. White. "Information Warfare Lab." *Educating Our Nation's Leaders*, April 1999.

WHITE, G. B. and R. E. Sward. "Developing an Undergraduate Lab for Information Warfare and Computer Security." *1st World Conference on Information Security Education*, June 1999.

Education Directorate

Publications:

MILLIS, Barbara. "Using Cases to Promote Adult Learning," in R. L Logan & R. Fromberg (Eds), *Peers in the Classroom: Case Studies in Adult Higher Education*, Stillwater, OK: New Forums Press, 1999.

Terrie Nolinske and **Barbara Millis**, "Cooperative Learning as an Approach to Pedagogy," *American Journal of Occupational Therapy*. Vol 53(1), Jan/Feb 1999.

MILLIS, Barbara and Philip G. Cottell, *Cooperative Learning for Higher Education Faculty*. Phoenix, AZ: Oryx Press, 1998.

MILLIS, Barbara. "Using Collaborative Technology To Promote Learning," in Connie Staley, *Teaching College Success*, Wadsworth, 1998.

MILLIS, Barbara. "Conducting Cooperative Focus Groups," *Cooperative Learning and College Teaching*, Vol 9 (2), Winter, 1998.

MILLIS, Barbara. "Good Practice in Cooperative Technology," *Cooperative Learning and College Teaching*, Vol 8 (2), Winter, 1997.

MILLIS, Barbara and Neil Davidson. "Motivating Through Cooperative Learning Techniques," *Futures Research Quarterly*. Vol 13 (3), Fall, 1997.

MILLIS, Barbara. "Evaluating a Consultation Program for Part-Time Adjunct Faculty" and "Using Case Studies To Train Instructional Consultants," in Kathleen Brinko & Robert Menges (Eds), *Practically Speaking: A Sourcebook for Instructional Consultants in Higher Education*. Stillwater, OK: New Forums Press, 1997.

MILLIS, Barbara. "Bringing Closure: Some Rapid Report-Out Methods" and "Send-a-Problem," *Cooperative Learning and College Teaching*, Vol 7 (3), Spring, 1997.

REVAK, Marie A., "USAF Academy Assessment Catalog: Hot Off the Press." *USAFA Educator* 7.3

REVAK, Marie A., "Ten Ways to Get Feedback on Your Teaching." *USAFA Educator 7.2.*

STILES, Randy J., M. E. Halloran, and **M. A. Revak.** "Computing at the United States Air Force Academy." *Journal for Computer Enhanced Learning 99.2.*

REVAK, Marie A., "Assessment in Little Bites." *Mathematica Militaris* 8.3.

REVAK, Marie A., "Got a Minute? Do Assessment." *USAFA Educator 7.1.*

REVAK, Marie A., "Focus on Assessment ... Writing a Better Test: Part I." *Colorado*

Mathematics Teacher 31.4. Reprinted in the *Wisconsin Teacher of Mathematics 49.3.*

Presentations:

HALLORAN, Margaret E. "Analysis of Foraging and Caching Behavior by Abert Squirrels: When the Grasshopper's Strategy is Better Than the Ants'". Pike's Peak Chapter of Sigma Xi, Colorado Springs, CO, Feb 99.

MILLIS, Barbara J. and **Marie A. Revak.** "Assessment as a Two-Sided Coin: Student Learning and Faculty Teaching." Preparing Future Faculty: Assessment and the Scholarship of Teaching Conference, Boulder, CO, Jan 99.

MILLIS, Barbara and Jim Greenberg, "Advancing Faculty, Departmental, and Institutional Vitality through Qualitative Assessment," Preconference Workshop, AAHE Assessment Conference, Assessment as Evidence of Learning: Serving Student and Society, Denver, CO, June, 1999.

MILLIS, Barbara. "Using Interactive Focus groups for Departmental Course and Program Assessments," AAHE Assessment Conference, Assessment as Evidence of Learning: Serving Student and Society, Denver, CO, June, 1999.

MILLIS, Barbara. "Using Cooperative Activities to Foster Deep Learning," (Offered Twice) and "Assessing Courses through Interactive Student Interviews," Teaching for a Change: Learning without Limits Conference, Colorado Springs, CO, June, 1999.

MILLIS, Barbara. "Cooperative Learning for Teaching and Training," USAA, San Antonio, TX, April 1999.

MILLIS, Barbara and C2C Joel Bolina, "Using Interactive Focus Groups for Departmental Course and Program Assessments," Educating Leaders for our Nation, West Point, Apr 99.

MILLIS, Barbara and three USAFA Cadets, "Student Leadership Teams," Educating Our Nation's Leaders, West Point, April 1999.

MILLIS, Barbara. "Creating a Personal Statement [for Medical School Applications]," Workshops for DFB Cadets, March, 1999.

MILLIS, Barbara, Anita Gandolfo, and Laura Border. "Cracking the Brass Ceiling? Women Civilians at Two US Service Academies," Panel, American Association of Higher Education Annual Conference, Washington, DC, March, 1999.

MILLIS, Barbara. "Promoting Critical Thinking," Plenary Address, US Naval Academy, March, 1999.

MILLIS, Barbara. "Using Cooperative Activities to Foster Deep Learning," US Naval Academy, March, 1999

MILLIS, Barbara . "Writing for Publication," Pikes Peak Education and Innovation Research Symposium, USAFA, January 1999.

MILLIS, Barbara . "Assessing Courses through Classroom Observations and Interactive Student Interviews," and "Promoting Critical Thinking through Writing," 18th Annual Lilly Teaching Conference, Oxford, OH, Nov 98.

MILLIS, Barbara and Phil Cottell. "Cooperative Learning in Higher Education," Preconference Workshop, 18th Annual Lilly Teaching Conference, Oxford, OH, Nov 98.

MILLIS, Barbara and Jim Greenberg. "Collaborating to Assess Courses and Programs," Preconference Workshop, The 23rd Annual Conference of The Professional and Organizational Network in Higher Education. Snowbird Resort and Conference Center, Snowbird, Utah October, 1998

MILLIS, Barbara . "Conducting Effective Classroom Observations," USAFA Preparatory School, October, 1998.

MILLIS, Barbara and **Jim Solti**. "An overview of 'Boot Camp for Profs'" DFAS Workshop, August 1998.

MILLIS, Barbara . "Cooperative Learning," Boot Camp for Profs, July, 1998.

MILLIS, Barbara . Closing Plenary, "An Interactive Student Interview Model for Course and Program Assessment," Assessment: Another Golden Opportunity, Colorado School of Mines, Golden, Colorado, 11 April 1998.

MILLIS, Barbara and **David Fitzkee**. "Using Interactive Focus Groups To Assess Programs and Courses," Taking Teaching Seriously: AAHE National Conference on Higher Education, Atlanta, GA, 21-24 March 1998.

MILLIS, Barbara . Plenary address, "Shifting Academic Gears: Guiding Student Learning in the 21st Century," Encuentro Intraauniversitario de Desarrollo de Faculda, and Consultant for conference of University of Puerto Rico System to establish regional Teaching and Learning Centers, Mayaguez, PR, 29-31 January, 1998.

STILES, Randy J., M. E. Halloran, and **M. A. Revak.** "Computing at the United States Air Force Academy." Second Annual Ubiquitous Computing Conference, Wake Forest University, NC, January 1999.

Department of Engineering Mechanics

Publications:

BEAUMONT, P. W. R and Greer, Jr, J. M. "Towards a Predictive Design Methodology for Composite Laminate Patches Based on Physical Modeling of Failure Processes," in *Proceedings of the 1998 FAA/DoD/NASA Conference on Aging Aircraft, NASA/CP-1999-208982/Part 2, pp. 545–553*, Williamsburg, VA, 1998.

FREDELL, R., Guijt, C.B., And Mazza, J.J. "An Integrated Bonded Repair System: A Reliable Means of Giving New Life to Aging Airframes," *Applied Composite Materials, Vol. 6, Issue 4, pp. 269–277*, July 1999.

GREER, JR., J.M. and Palazotto, A. N. "Nonlinear Through-Thickness Behavior of Shells Using 2-D Finite Elements", *in Proceedings of the 40th AIAA SDM Conference*, St Louis, April, 1999.

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MÜLLER, R., Fredell, R.S. "Analysis of Multiple Bonded Patch Interaction: Simple Design Guidelines for Multiple Bonded Repairs in Close Proximity," *Applied Composite Materials, Vol. 6, Issue 4, pp. 217–237*, Jul 99.

MÜLLER, R., Fredell, R.S., Guijt, C.B., And Dally, J. "Experimental Verification of Rose's Constant K Solution in Bonded Crack Patching," *Applied Composite Materials, Vol. 6, Issue 4, pp. 205–216*, July 1999.

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VERHOEVEN, S., Guijt, C.B., and Vlot, A. "In Service Effects on Bonded Composite Patches," *in Proceedings of the 1998 USAF ASIP Conference*, San Antonio, TX, Dec 98.

VLOT, A., Verhoeven, S., Woerden, H. J. M., Guijt, C. B., Greer, Jr., J. M. "Fiber Metal Laminate Patches for Bonded Repair of Aircraft Fuselages", In *Proceedings of the International Conference on Aeronautical Fatigue (ICAF) Conference*, Seattle, Jul 99.

Department of Foreign Languages

Publications:

PALA. A. L. "US Arms Transfer Policy for Latin America: Lifting the Ban on Fighter Aircraft." *Airpower Journal,* Spring 1999.

SUPINSKI, S. B. and M. Verano. "CD-Based Material for Beginning and Intermediate Foreign Language Students." *Proceedings of the International Association of Science and Technology in Education International Conference on Computers and Advanced Technology in Education* (CATE'99), Philadelphia, Pennsylvania.

SUPINSKI, S. B. and M. Verano. "CD-Based Material for Beginning and Intermediate Foreign Language Students." *USAFA Educator*, USAFA CO, Spring 1999.

SUPINSKI, S. B.. "An Experimental Comparison of Strategies Using Cooperative Learning and Interactive Video: Lessons for the Interactive Classroom." *Journal of Interactive Learning Research*, Vol. 10 (2). 1999.

HUGHES, H. "Build the Culture Bridge." *People's Daily National Newspaper,* Apr 12, 99.

Presentations:

SUTHERLAND, R. L. "Free Homepages for Teachers and Students." Montana Association of Language Teachers, Great Falls, Montana, October 1998.

SUTHERLAND, R. L. and T. Sutherland. "Do the Web with Windows: Word, FrontPage '98, Internet Explorer." Technology in Edu-cation Conference, Snowmass, CO, Jul 98.

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USAFA Research Points Of Contact

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